

Railway applications— Automated Urban Guided Transport (AUGT) safety requirements

ICS 45.060

National foreword

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**Automated Urban Guided Transport (AUGT)
safety requirements**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RAILWAY APPLICATIONS –
AUTOMATED URBAN GUIDED TRANSPORT (AUGT)
SAFETY REQUIREMENTS**

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A PAS is a technical specification not fulfilling the requirements for a standard but made available to the public.

IEC-PAS 62267 has been processed by IEC technical committee 9, Electrical equipment and systems for railways. It defines the essential safety requirements for an Automated Urban Guided Transit system (AUGT).

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document

Draft PAS	Report on voting
9/868/PAS	9/898/RVD

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned will transform it into an International Standard.

This PAS shall remain valid for an initial maximum period of three years starting from 2005-12. The validity may be extended for a single three-year period, following which it shall be revised to become another type of normative document or shall be withdrawn.

INTRODUCTION

This Publicly Available Specification is a generic guideline providing recommendations which can help transport authorities and authorities having jurisdiction to define appropriate and safe Automated Urban Guided Transport (AUGT) requirements for their specific application, taking into account that the requirements are determined by their own specific risk analysis, as is required in the life-cycle RAMS process according to IEC 62278 with respect to the different risk acceptance principles in the world.

The recommendation of this PAS for the definition of global and generic safety requirements is based on the experience coming from proven solutions throughout the world.

Due to the diversity of possible technical solutions that may be adopted in different circumstances, the requirements defined by this PAS should be considered as minimum requirements. Each technical solution chosen or aspects of a particular topographic, environmental, social or legal consideration may generate their own additional safety requirements. It is expected that hazard analysis is carried out to establish any such additional requirements.

Therefore, the PAS does not prescribe specific equipment or means necessary to mitigate the various hazards. Rather, it prescribes a list of foreseeable hazards to be followed, as a minimum, in the mandatory and comprehensive safety analysis of each project with respect to the driver and staff functions replaced by automated equipment. Additionally, it describes possible and proven solutions that may be considered in the comprehensive safety analysis of each project.

However, the PAS does not take into account all different hazards that may arise from the large number of different applications used in the world. Also, this PAS cannot describe completely all the safety measures needed for each specific application.

Moreover, the PAS does not necessarily require choosing a safety measure for each possible hazard where the associated risk is already considered tolerable. As stated in IEC 62278, it is the responsibility of the transport authority in agreement with the authority having jurisdiction and with respect to their specific risk acceptance principles and legal requirements, to decide on the tolerability of each hazard and on the implementation of a specific safety measure.

It has to be taken into account that the PAS is basically a specification related to railway applications. To avoid contradictions with all other standards, even non-IEC standards, which are relevant in the field of railway applications including civil engineering, no values or considerations which obstruct existing standards in their field of application are given. Specific values or considerations are only used if they are exclusively used for AUGT purposes. If values are used, then their derivation and its basis are provided in the informative annexes.

NOTE WG 39 of TC 9 wishes to publish the state of its document reflecting the situation at June 2005. Attention is drawn to the fact that this document is incomplete. Consequently, the recommendations described in the present PAS are subject to changes by WG 39.

RAILWAY APPLICATIONS – AUTOMATED URBAN GUIDED TRANSPORT (AUGT) SAFETY REQUIREMENTS

1 Scope

This Publicly Available Specification covers general high-level safety requirements for all types of automated urban guided transit systems with independent self-propelled trains operating on an exclusive guideway.

This PAS deals with safety requirements needed to compensate for the absence of the driver or attendant staff who are typically responsible for the activities mentioned in Table 1. Table 1 describes the relationship between the grade of automation and basic system functions.

The requirements are restricted to the transit system as defined in Clause 5 and to Driverless Train Operation (DTO) and Unattended Train Operation (UTO) modes of operation as defined in 3.2 (see the shaded areas in Table 1).

Table 1 – Grades of automation

Basic functions of train operation		On-sight train operation TOS	Non-automated train operation NTO	Semi-automated train operation STO	Driverless train operation DTO	Unattended train operation UTO
		GOA0	GOA1	GOA2	GOA3	GOA4
Ensuring safe movement of trains	Ensure safe route	x (points command/control in system)	S	S	S	S
	Ensure safe separation of trains	x	S	S	S	S
	Ensure safe speed	x	x (partly supervised by system)	S	S	S
Driving	Control acceleration and braking	x	x	S	S	S
Supervising guideway	Prevent collision with obstacles	x	x	x	S	S
	Prevent collision with persons on tracks	x	x	x	S	S
Supervising passenger transfer	Control passengers doors	x	x	x	x	S
	Prevent person injuries between cars or between platform and train	x	x	x	x	S
	Ensure safe starting conditions	x	x	x	x	S

Basic functions of train operation		On-sight train operation TOS	Non-automated train operation NTO	Semi-automated train operation STO	Driverless train operation DTO	Unattended train operation UTO
		GOA0	GOA1	GOA2	GOA3	GOA4
Operating a train	Set in/set off operation	x	x	x	x	S
	Supervise the status of the train	x	x	x	x	S
Ensuring detection and management of emergency situations	Perform train diagnostic, detect fire/smoke and detect derailment, handle emergency situations (call/evacuation, supervision)	x	x	x	x	S and/or staff in OCC
NOTE x = the responsibility of operations staff (may be realised by technical system); S = shall be realized by technical system.						

This PAS does not specifically look at security issues. However, aspects of safety requirements may apply to assuring security within the transit system.

NOTE The definitions of “security” and “safety” are given in IEC 62278.

The application of this PAS is subsidiary to the responsibility of the transport authority in accordance with its respective supervisory body and specific laws and decrees applicable to the transport system location.

The application of this PAS must take account of

- social risk acceptance in different cultures or different national legal regulations (for example, SHOREI, BOStrab) or principles (for example, GAME, ALARP, MEM);
- laws and decrees in different states;
- special or different requirements coming from the authority having jurisdiction or from an independent assessor in charge of the specific project;
- the responsibility for “safe operation” by the transport authority.

This PAS does not apply to the following types of transportation systems, unless specifically required by the system owner.

- Automated People Movers (APM) operating entirely inside a privileged environment such as an airport, a commercial centre, a leisure resort;
- amusement rides and roller-coasters, generally featuring a single station so that passengers board and alight the system at the same location;
- Intercity and mainline train services, generally operating in a rural environment on part of their routes;
- cable-driven systems;
- systems featuring electronically guided vehicles (with optical sensors, or magnetic sensors, or similar devices/systems).

The PAS is not concerned with risk arising during work for construction, installation, modification and dismantling of the system.

This PAS is not concerned with pre-existing DTO or UTO systems (for definitions, see 3.2) that were designed before this PAS took effect.

In the case of upgrading an existing transit system to a DTO or UTO system, the risks associated with the existing system are outside the scope of this PAS. However, the risk assessment process described herein may be relevant, and its application is at the discretion of the safety authority having jurisdiction.

In the case of extending or modifying an existing DTO or UTO system in operation, this PAS applies only if the change is significant as determined by the safety authority having jurisdiction; but the risks due to the relationship with the unchanged parts of existing systems (rolling stock, traction power supply, signalling, platforms) shall be taken into account.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62278, *Railway applications – Specification and demonstration of reliability, availability, maintainability and safety (RAMS)*

3 Terms, definitions and abbreviations

For the purposes of this document, the following terms, definitions and abbreviations apply.

3.1 Transportation systems

3.1.1 Automated Urban Guided Transport (AUGT)

metropolitan scale urban system featuring DTO or UTO, as defined below, with self-propelled vehicles mechanically guided on a guideway, which is separated from general road and pedestrian traffic, operating in an urban environment, and open to the general public without restrictions:

- a) systems accepting exclusively automated trains are called “closed systems”;
- b) systems accepting a mixed traffic of automated trains and conventional trains (i.e., manually operated or semi-automated) are called “open systems”

3.1.2 Automated People Movers (APM)

See ASCE (American Society of Civil Engineers) standard 21: Automated People Movers – Part 1.

3.2 Grades of automations

3.2.1 On-sight Train Operation (TOS)

operation in which the driver (i.e. the train operator) has full responsibility and no technical system is required to supervise his activities

3.2.2 Non-automated Train Operation (NTO)

operation in which the driver (i.e., the train operator) is in the front cabin of the train observing the guideway and stopping the train in case of a hazardous situation. Acceleration and braking are controlled by the driver in conformance with wayside signals or cab-signalling. The

signalling system and any associated wayside system supervise the activities of the driver; however, with respect to the signals and the speed, this supervision may be discrete, semi-continuous or continuous. Safe departure of the train from the station, including door closing, is the responsibility of the operations staff whether onboard the train or on the station platform

3.2.3 Semi-automated Train Operation (STO)

operation in which the driver is in the front cabin of the train observing the guideway and stopping the train in case of a hazardous situation. Acceleration and braking is automated and the speed is supervised continuously by the system. Safe departure of the train from the station is the responsibility of the operations staff, whether on board the train or on the station platform

3.2.4 Driverless Train Operation (DTO)

operation in which additional control and detection systems are needed compared with STO because there is no driver in the front cabin of the train to observe the guideway and stop the train in case of a hazardous situation.

An operations staff person is necessary onboard. Safe departure of the train from the station, including door closing (open point), can be the responsibility of the operations staff or may be done automatically

3.2.5 Unattended Train Operation (UTO)

operation in which additional control and detection systems are needed compared to DTO because there is no on-board operations staff person necessary.

Safe departure of the train from the station, including door closing, is done automatically

3.2.6 Automated transit system

DTO or UTO mode

3.2.7 Conventional transit system

TOS, NTO or STO mode

3.3 Vehicles

3.3.1 independent train

train which is constructed (designed) for independent train operation

3.3.2 dependent train

train which is designed for operation with other traffic

3.3.3 passenger cabin

part of a train which is used for the transport of passengers

3.3.4 passenger transfer door

train door which provides the passenger transfer between the passenger cabin and the platform in the stations. It could also be used as an emergency exit in cases of hazardous situations, when the status of the passenger cabin changes into an unsafe status